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Kevin KLILAND et al.

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For: ARRANGEMENT FOR PACKET  
BASED CALL-RELATED HIGH  
AVAILABILITY SOLUTIONS

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CLAIM FOR CONVENTION PRIORITY

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

The benefit of the filing date of the following prior foreign application in the following foreign country is hereby requested, and the right of priority provided in 35 U.S.C. § 119 is hereby claimed:

Norwegian Patent Application No. 20005257

Filed: October 19, 2000

In support of this claim, enclosed is a certified copy of said prior foreign application. Said prior foreign application was referred to in the oath or declaration. Acknowledgment of receipt of the certified copy is requested.

Respectfully submitted,

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It is hereby certified that the annexed document is a true copy of the above-mentioned application, as originally filed on 2000.10.19

2001.08.29

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Tittel:

Fremgangsmåte for pakkebasert kommunikasjon relatert til løsninger med høy tilgjengelighet

Fullmektig:

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## A METHOD FOR PACKET BASED CALL-RELATED HIGH AVAILABILITY SOLUTIONS

### Field of the invention

The present invention is related to large-scale packet  
5 based communication for providing high availability and redundant network implementations. Only the term redundant is used in the text.

### Background of the invention

For exchange of information and communication between nodes  
10 in different layers in a packet switched systems, it is of great importance that redundancy is achieved for availability purposes. If a preferred node is out of function, there preferably has to be a substitute at present. Thus, relevant address information to alternative nodes always has to  
15 be updated and presented for the system so that alternative routes may be utilized. The problem is that this may be both time and resource consuming.

Address information of horizontal nodes in network implementations typically has to be configured per node initially, or at least per layer, or more advanced lookup protocols might be utilized. The run-time information exchange  
20 between horizontal nodes might be performed in two ways:

- by the use of a more or less advanced peer to peer real time protocol that ensures that the peer contains  
25 the same data. The disadvantage is that this solution is load consuming during normal execution/traffic, besides that the implementation of the solution is complex,
- by the use of writing and reading to shared resources.  
30 The peers write and read typically to a file system or a database. The actual context switching in this case

is more time consuming due to the fact that all the data has to be read from the shared resources before the peer actually is up and running.

For vertical exchange of information, initial configuration data concerning addresses of nodes within the next layer typically has to be configured per node, per layer or by the use of more advanced lookup protocols. Traditionally, each node contains all the information on the availability of the next layer by itself. Then each node has to contain data concerning from which node a message was sent, and to which node the message is to be passed. Persistent data storage must then be present for each node, or each layer, which might be rather expensive. Advanced protocols for updating the different layers on the status of the nodes of the adjacent layers might be introduced instead, but this really would be complex and load consuming.

The present invention relates to vertical exchange of information.

#### Summary of the invention

It is an object of the present invention to provide a method which eliminates the drawbacks described above. This method is characterized by the features defined in the claims enclosed.

More specifically, the object of the present invention is to provide a method for high availability and redundant network implementations by introducing a new mechanism for exchanging vertical information (e.g. address information) between nodes in run-time.

The main advantages of the present invention are short implementation time and little processing overhead during normal execution. In addition, few shared resources has to be maintained.

### Brief description of the drawings

In order to make the invention more readily understandable, the discussion that follows will refer to the accompanying drawings.

- 5 Fig. 1 is a block diagram showing an example of a large scale, redundant deployed multimedia packet based network and its possible connections.

Fig. 2 shows a block diagram illustrating an example of a normal user registration in the network of fig. 1.

- 10 Fig. 3 shows a block diagram illustrating an example of a confirmation of the registration of fig. 2.

Fig. 4 shows a block diagram illustrating an example of a call set-up in the network of fig. 1 using a redundant node.

### 15 Detailed description

- In the following, the present invention will be described with reference to the figures mentioned above. First, a general description will be disclosed, and thereafter an example of a user registration, confirmation and a call  
20 set-up according to the present invention.

Fig. 1 shows an example of a large scale, redundant deployed multimedia packet based network and the possible connections. The abbreviations used in the figure are defined as follows:

- 25     ◦ EP, Endpoint
- A-N, Access Node. Typically located on enterprise segments. Handling access specific services e.g. as con-

version between different protocols or formats. Also typically handling enterprise firewall traversal

- 5       • N-N, Network Node. Typically located on ISP segment, handling routing, network QoS (Quality of Service) etc.
- T-N, Transit Node. Compulsory in order to traverse ISP's firewalls
- U-N, User Node. Handling user specific events, such as user registration etc.
- 10     • S-N, Service Node. Handling service specific events.

The present patent application discloses a new method for exchange of vertical information in run-time.

Only the layers that hold registrations, and that issue messages towards the endpoint, contain the vertical redundancy information for the downward (from S-N towards EP) direction. This is typically the user/service node. Thus, redundancy in the downward vertical direction will be on a per-registration basis. For the upward (from EP towards S-N) direction, each node will maintain the different alternative addresses on the next layer.

Typically, the vertical nodes will be informed about the other layers in connection with user registration. The available downward redundancy paths for a registration will be communicated to the node holding the registration in the registration message. The upward redundancy will be partially configured, partly communicated in registration confirmation messages.

By the use of timeout, a node within one layer may detect that a node on another layer is dead. Upon this detection,

the alternative addresses for that level may be read from the message itself.

Generally, the normal flow is as follows:

- 5       • All the nodes are configured with the addresses of all their peers (e.g. the left N-N is configured with the address of the right N-N) and the address of the next layer in the direction from the endpoint to the user/service node. It is assumed that the next hop may later give a confirmation message on the redundant  
10       peers on that same layer back to the issuer of the message.
- 15       • On endpoint registration, all the nodes add relevant information in the message comprising information of all redundant peers. The endpoints register information of both originating and terminating sides. The redundancy information in the downward direction is a part of the registration.
- 20       • Typically during call set-up, the message will go from the originating endpoint towards the user/service node at the originating side to the user/service node at the terminating side and towards the terminating endpoint. At the terminating side, the *link index* is used as described below.

25       Typically, routing is used for address resolution between an N-N and another N-N or the U-N. Plain network calls will go between N-N only. User/service related calls will go between N-N to U-N on originating side and from U-N (originating) to U-N (terminating) to N-N (terminating).

30       The types of information that have to be addressed are such as:



- Addresses. Each node or the message itself has to contain data stating from which node a message was sent, and to which node the message is to be forwarded.
  - Endpoint or endpoint-like data. The home environment, represented by a user/service node, has to receive endpoint and/or network adapter like information. NA like information might be access type information (e.g. H323Phone, H323Pc PstnUni, PstnNni, H320Uni, H320Nni, GsmUni, GsmNni, PbxUni), or similar SipPhone, SipPc etc. for SIP systems. Due to registration of endpoints towards a user/service node, the user/service node contains information describing the whole path from the endpoint towards the user/service node.
- 15 If the message itself is to contain address information, the following elements have to be added in the messages:
- Address pair list. Each node in the system adds its addresses to the address pair list. In fact, there might be several addresses for each node: The physical address of the node, the address of the voice channel, the media channel, etc. Besides, each layer is configured with at least physical address information of all its peers, hence all of these are added in the message when an endpoint registers towards the user/service node. The addresses of the peers might be set in a prioritised way.
  - Link index. The link index identifies which node is currently being addressed in the address pair list. Messages might be issued either from the endpoints or the home environment, U-N. The link index only has to be used when messages are issued from the home environment (user/service node). Then the whole addressing path down to the endpoint should be included in the

messages before the message traverse to the endpoint.  
On its way, only the link index is modified.

In the following, an exemplary embodiment of the present invention is described.

5 Fig. 2 shows the data relevant for redundancy, which data is exchanged during a normal user registration. Each node involved adds its own address as well as its peers' address to the address pair list. These data are stored for each user at the U-N. At the S-N layer, only user data and no  
10 address pair list data is stored. The figure illustrates the redundant peers at each layer, but in this example, all the primary nodes are functioning normally. The connections drawn without any arrow or message are other possible ways to route a message.

15 Fig. 3 shows the response given from the system on the registration previously discussed. The registration confirmation is initiated from the U-N layer. Every node may inform the underlying layer of its redundant peers. In this way, all nodes may be updated of the available nodes at the next  
20 upward layer. Also, the EP will have the possibility to contact two alternative addresses for future call set-ups.

Fig. 4 shows an example of a call set-up in a network updated by way of the above described registration and confirmation. In this example, a user registered at U-N b, using the EP2, is making a call to a user (User B) registered  
25 with the EP 1 at U-N 1, the registration details for EP1 are as shown in fig. 2 and fig. 3. At the terminating side, A-N 1 is down. The T-N 1 may then, using the address pair list stored during registration of EP 1 and now received in  
30 the Set-up from N-N 1, reach EP 1 using the redundant node A-N 2. In this example, no communication with the S-N is shown, since it has no relevance with the redundancy on the A-N layer.

The main advantages of the present invention are short implementation time and little processing overhead during normal execution. In addition, few shared resources has to be maintained.

- 5 It should be noted that the example described above is simplified in order to emphasize the redundancy solution in the present invention. Another message flow will be accomplished in a real system. In fact, any system comprising a similar deployed system as described might utilize the pre-  
10 sent invention.

Moreover, the example is for illustrative purposes only, and is not restricting the present invention in any way. Other variations and substitutions may by utilized without departing from the scope of the invention.

15



## P a t e n t   c l a i m s

1. Method for providing high availability and redundancy in communication between an endpoint (EP 1) at a terminating side and an endpoint (EP 2) at an originating side in a packet switched network, said network being virtually divided into horizontal layers comprising a number of nodes, wherein a plurality of said nodes are associated with said terminating side and a plurality of said nodes are associated with said originating side, nodes within the same layer associated with the same side said to be peers and holding relevant information about each other, each node within each layer, in addition to the endpoints, being connected to at least all peers of adjacent layer(s) within the same side respectively,  
c h a r a c t e r i z e d   i n the following steps, executed at each side respectively, prior to said communication:

- sending a first message vertically by the endpoint associated with the current side from one of said nodes within the horizontal layer adjacent to said endpoint to one of said nodes within a higher horizontal layer passing through one of said nodes within each intermediate layers,
- for each passed node, adding relevant information concerning current node and its peer(s) to said first message,
- upon receiving said first message, storing said relevant information for each passed node and its peers included in said first message in said node within the higher layer,
- in response to said first message, sending a second message in the opposite direction from said node within the higher layer to said endpoint passing

through said nodes of said intermediate layers, said second message always containing the relevant information of the previously passed node and its peer(s), and

- 5       • in each node and in the endpoint, storing the relevant information of the previously passed node and its peer(s) when receiving said second message.

2. Method as defined in claim 1,  
c h a r a c t e r i z e d   i n   that the step of sending a  
10 first message by the endpoint relates to user registration, and the step of sending a second message from said node within the higher layer relates to confirmation thereto.

3. Method as defined in claim 1 or 2,  
c h a r a c t e r i z e d   i n   that said relevant information is one or more address(es), and said relevant information provided from said first message stored in the  
15 higher layer is an address list of the peers for each layer.

4. Method as defined in any of the preceding claims,  
20 c h a r a c t e r i z e d   i n   that said horizontal layers include an access layer comprising access nodes (A-N) handling access specific services, a network layer comprising network nodes (N-N) handling routing and network Qos (Quality of Service), a transit layer comprising transit  
25 nodes (T-N) for traversing firewalls, a user layer comprising user nodes (U-N) for handling user specific events as user registration, and a service layer comprising service nodes (S-N) for handling service specific events, said horizontal layers arranged in the above mentioned order.

30 5. Method as defined in claim 4,  
c h a r a c t e r i z e d   i n   that said access layer is the lowest one and adjacent to the endpoint, and said service layer is the highest one.

6. Method as defined in claim 4 or 5,  
c h a r a c t e r i z e d i n that said higher layer is  
the user layer.

7. Method as defined in any of the preceding claims,  
s c h a r a c t e r i z e d i n that there are at least  
two peers per layer at each side.

8. Method as defined in the claims 3-7,  
c h a r a c t e r i z e d i n that more than one of  
said addresses may be associated with a single node.

10 9. Method as defined in any of the preceding claims,  
c h a r a c t e r i z e d i n that said originating  
side and said terminating side are connected to each other  
through a redundant coupling between the user nodes (U-N)  
and the network nodes (N-N) at each side.

15 10. Method as defined in claim 3-9,  
c h a r a c t e r i z e d i n utilizing the stored ad-  
dresses of the peers of the next layer provided by said  
second message for routing packets or other messages in-  
volved in said communication from a current node in the  
20 vertical direction away from associated endpoint.

11. Method as defined in claim 3-10,  
c h a r a c t e r i z e d i n utilizing the address  
list stored in said higher layer for routing packets or  
other messages involved in said communication in the verti-  
25 cal direction towards associated endpoint by adding said  
address list to said packets or other messages when passing  
said higher layer and, thereby, finding a proper route to  
said endpoint.

12. Method as defined in claim 10 or 11,  
30 c h a r a c t e r i z e d i n if a node to which one of  
said packets or messages otherwise would have been routed

is down, routing said packet or message to one of the peers of said node.

13. Method as defined in any of the preceding claims, characterized in that said communication  
s initiates some kind of service, e.g. a call and/or a call set-up.

